Puncture of the Superficial Sylvian Vein for Embolisation of Cavernous Dural Arteriovenous Fistula

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Summary

Dural arteriovenous fistulas (DAVF's) of the cavernous sinus are curable by endovascular means in the vast majority of cases. Both transarterial and transvenous approaches by femoral route can be used for closure. In rare cases with unsuitable anatomy or angioarchitecture, an endovascular approach is proposed by open surgical exposure of a major venous outflow, e.g. the superior ophthalmic vein. We report on a case of unsuccessful attempts at transarterial and transvenous catheter navigation through traditional endovascular routes, where surgical exposure of the major cortical venous drainage was necessary. A direct puncture of the sylvian vein allowed placement of a microcatheter in the cavernous sinus and occlusion of the fistula by coils.

Introduction

The treatment of choice for dural arteriovenous fistulas (DAVF) of the cavernous sinus (CS) is closure by endovascular means [1,2,7,16]. According to the given type of arterial supply, anatomy of the cavernous sinus and the type of venous drainage, different endovascular approaches can be used such as transarterial, or retrograde transvenously through the inferior petrosal sinus, facial and superior ophthalmic vein (SOV) or direct cannulation of this vessel. We report a case in which open surgery and endovascular techniques were combined for effective treatment of a cavernous dural arteriovenous fistula.

Case

A 57-year-old woman was referred to our hospital in 1992 for treatment of spontaneous cavernous arteriovenous fistula. The patient presented with exophthalmos, chemosis and pain in the left eye, with no neurological symptoms. A CT scan showed a dilated right superior ophthalmic vein. Digital subtraction angiography (DSA) revealed a dural arteriovenous fistula located at the inferior lip of the superior orbital fissure involving the left cavernous sinus (figure 1). The fistula was fed by meningeal branches of the external carotid (middle menigeal artery) and internal carotid (ophthalmic artery, cavernous branches) territory. Venous drainage was both anterior into a dilated superior ophthalmic vein and posterior via the sphenoparietal sinus into the superficial sylvian veins towards the transverse sinus. The inferior petrosal sinus (IPS) was not opacified on either side.

For transarterial embolisation a microcatheter was navigated first into the middle meningeal artery (MMA). The feeding branch to the fistula was occluded by injection of glue (NBCA) without reaching the fistula site. In the meningohypophyseal trunk of the cavernous ICA as well as in the feeding branch originating from the ophthalmic artery no proper position for injection of liquid adhesives could be attained due to elongated supra-aortic vessels.

Transvenous catheterization of the inferior petrosal sinus was attempted first but failed because of thrombosis. The facial vein approach

A

B

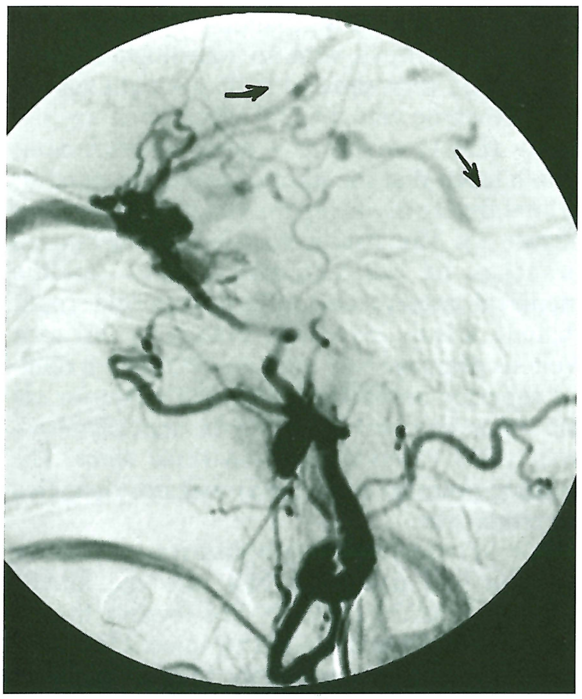

Figure 1 DSA revealed a dural arteriovenous fistula of the cavernous sinus with cortical venous hypertension. A) Lateral view of the left common carotid artery injection shows the a.v. fistula supplied by the ophthalmic artery, draining into the superior ophthalmic vein (arrow) and superficial sylvian vein (arrowheads). B) Lateral view of left external carotid artery demonstrates the supply by the middle meningeal artery and venous drainage via superficial sylvian vein towards the transverse sinus (arrows).

also failed to provide access due to significant loops of the angular and superior ophthalmic veins. No experienced orbital surgeon was available to dissect the superior ophthalmic vein at that time in our hospital. Impairment of the patients visual acuity required urgent treatment so that craniectomy and exposure of the draining superficial sylvian vein was finally suggested. After pterioneal craniectomy the vein was clipped and punctured with an 18 G needle.

Then a microcatheter could easily be navigated through the sphenoparietal sinus into the CS (figure 2). Delivery of two small fibered coils directly at the fistula site resulted in a significant reduction of the shunt flow. A few minutes later the fistula was no longer visualized indicating ongoing thrombosis, so that full packing of CS seemed unnecessary and the procedure was completed. The patient's clinical symptoms improved and she recovered completely within the following two weeks.

Follow-up five years later confirmed a stable result with complete occlusion of the fistula and no clinical or angiographical sign of recanalization (figure 3).

Discussion

Endovascular treatment of cavernous carotid fistulas as the method of choice is well accepted [1]. There are different approaches for occlusion of a dural arteriovenous shunt located at the cavernous sinus. Manual compression of both the carotid artery and the internal jugular vein by the patient's contralateral hand is a simple and non-invasive technique with a success rate of up to 34% reported [2].

Manual compression of the ophthalmic vein draining the malformation in the internal canthus may also be recommended in cases of dural cavernous shunts with sole ophthalmic venous drainage.

The chance of closing such a.v. fistulas endovascularly clearly depends on the arterial and venous angioarchitecture. Embolisation of arterial feeders arising from the ECA can be performed either by particles (PVA, Polyvinylalcohol) or better by liquid adhesives (NBCA, glue). However, the procedure may result in incomplete occlusion. Although the use of NBCA requires greater operator experience [2,3], it is far more effective in terms of permanent closure than particles, which often tend

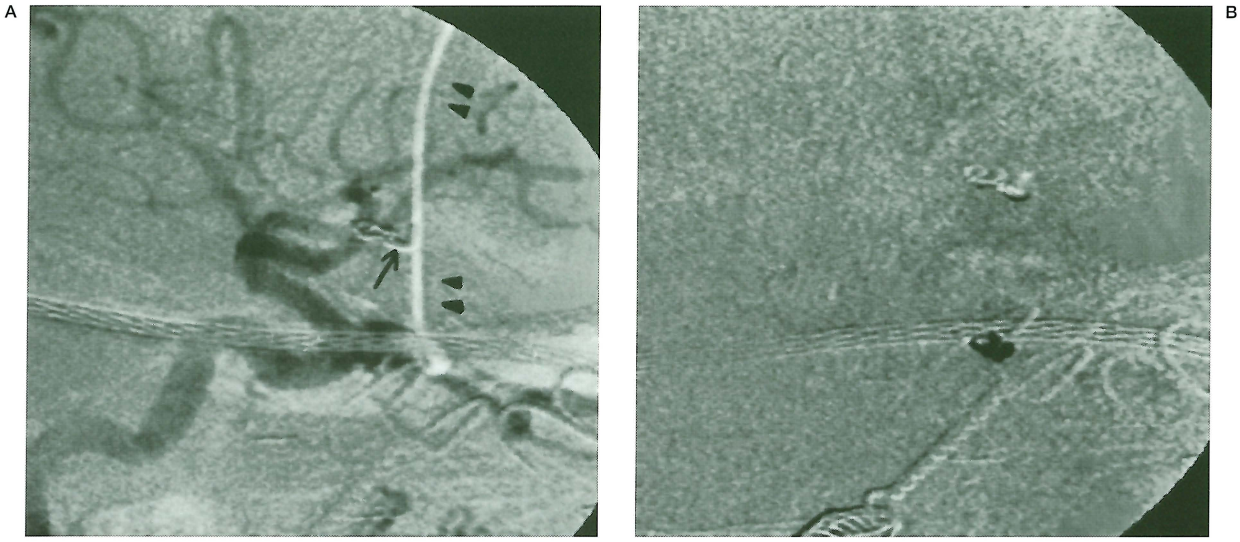

Figure 2 Surgical exposure and puncture of the superficial sylvian vein. A) Injection of the left internal carotid artery revealed the position of the microcatheter (arrowheads) at the fistula site after the vein was clipped (arrow). B) "Blank" Road Map after delivery of two fibered coils.

to reopen after a few months. Halbach[2] reported external carotid embolisation resulting in complete cure in 78% and improvement of symptoms in 20% of cases and a complication rate of 4%. As in the case described above, dural cavernous ICA branches such as the inferolateral trunk or the meningohypophyseal trunk are often very small and can only be catheterized close to their origins which prevents injection of embolic agents in all cases[17].

Thus transvenous approaches to the cavernous sinus are safe, often more effective, and nowadays are considered the treatment of choice by some authors[1,2,6,16]. Depending on the type of venous drainage (anterior, posterior, cortical) and the anatomic situation, there are different venous routes for navigation of microcathteters.

The inferior petrosal sinus (IPS) represents the simplest and shortest way and permits successful treatment in most cases. Even if the IPS is not angiographically visualized it might be possible to pass through[1,2]. Jahan[16] recently described a case where the transvenous approach through the pterygoid plexus provided access to the cavernous sinus for successful occlusion of a dural a.v. fistula.

In cases with anterior type drainage, the transvenous catheterization can also performed via the facial and superior ophthalmic vein[2]. This approach was first described by Courtheoux[4], after Peterson[5] reported a successful occlusion of a traumatic CCF in 1969. Recently it has become a widely-used technique that, in the majority of cases, allows placement of embolic agents at the fistula site resulting in effective occlusion of the a.v. shunt.

If the draining veins are not dilated enough, too tortuous or have stenotic segments, it may be difficult and sometimes impossible to navigate a microcatheter to the fistula site. In these situations, the cut down and direct cannulation of the SOV performed by a skilled orbital surgeon is a good alternative[6]. However, during catheter manipulation in the SOV, one should

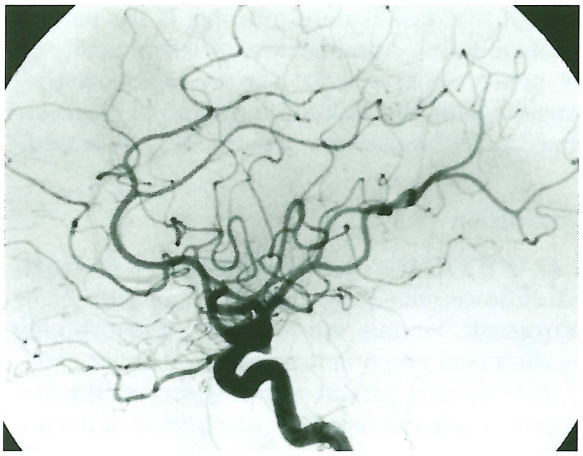

Figure 3 Angiographic follow-up after 5 years. Lateral view of the left and right (not shown) common carotid artery injection confirmed permanent occlusion of the fistula with no sign of recanalization.

be aware that rupture of an arterialized vein in the orbit may lead to serious bleeding and significant deterioration of visual acuity [7,10,14]. The puncture of SOV might also be difficult or impossible, if this vein is tortuous, too small, has anatomical variations or is thrombosed [6].

In rare situations direct puncture of deep SOV or the CS itself can be an alternative approach [6,8]. The combination of surgical and endovascular techniques was described by Mullan [9] and Tress [10] for treatment of Cavernous DAVF. Chaloupka [14] discussed the necessity of combined neuroradiological and neurosurgical treatment based on a case of complete anatomical compartmentalization of the cavernous sinus limiting definitive endovascular therapy.

DAVF's of the cavernous sinus without cortical venous drainage are usually benign diseases and therefore should always be managed as noninvasively as possible. In cases with cortical venous drainage, patients may suffer from severe neurological symptoms or life-threatening haemorrhage. Open surgical intervention for assistance of catheter navigation into the cavernous sinus is more invasive than endovascular techniques without craniectomy [3]. Puncture of an arterialized cortical vein carries some additional risks, but should be safe in the hands of an experienced vascular neurosurgeon.

Nevertheless, the approach described above remains rather exceptional and should be restricted to cases in which traditional endovascular routes (transarterial, retrograde transvenous, transorbital) have already failed and the clinical situation is deteriorating. If the patient is endangered, either by loss of visual acuity or by neurological deficits due to venous hypertension with the risk of intracranial haemorrhage [2], more aggressive treatment is indicated.

Conclusion

DAVF's of the cavernous sinus can be treated endovascularly by transfemoral arterial or retrograde venous approach or transorbitally by direct cut down in the vast majority of cases. If this fails in a patient who is deteriorating and urgent treatment is indicated, surgical exposure and cannulation of a cortical draining vein can be used as access to the cavernous sinus and may provide complete closure of a dural cavernous fistula in selected cases.

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